

Chapter 12

Developing Institutional Support for Large-Scale Reforestation

As long as the task environment of an institution remains repetitive, stable, and predictable, a set of fixed routines may prove exceptionally efficient. In most economies and in human affairs generally, this is seldom the case, and such routines are likely to be counter productive once the environment changes appreciably.

(Scott 1998, p. 354)

Introduction

Earlier chapters described the gradual loss of natural forests and the increase in the area of under-used former agricultural land across the Asia-Pacific region. The growing interest in different forms of reforestation has also been described. This means forestry practices are changing. Many new groups, in addition to state forestry agencies, are becoming involved in reforestation including private companies and smallholders. There are also other stakeholders with an interest in what is done because they are users of the goods and services being generated by the newly-established forests. This diversity of participants means the policies and practices that served in the past are becoming increasingly out of date. But what types of changes are needed to deal with the new circumstances? This chapter is concerned with the institutions and policies needed if reforestation to be undertaken on a national scale and at a rate that matches the rate at which forest and land degradation is occurring.

Ostrom (2005) has defined institutions as being the prescriptions or rules that humans use to organise all forms of repetitive and structural interactions. That is, they can be seen as the arrangements developed to coordinate collective action. Institutions include such things as traditional local customs, industrial codes of practice as well as national arrangements used to organise or regulate industries or social interactions. A large variety of informal or formal institutions have evolved to enable collective management of natural resources. Some of the principles emerging from the study of these provide useful insights into the types of institutions needed to encourage reforestation. But, before considering these policy and institutional

issues further, it is useful to firstly consider the ecological and socio-economic context in which future reforestation is likely to occur.

The Future Context?

If the rate of deforestation and degradation experienced in recent years does not decline then the environmental and socio-economic problems described earlier will continue and the rate at which they develop will possibly accelerate. However there are a number of other changes underway that will be equally important. Some of these are likely to strongly influence future opportunities for reforestation. They include:

Population Growth and the Need for Greater Food Production

By 2000, the world's population had reached 6.1 billion and it is projected to reach 9.2 billion by 2050 (United Nations 2007). This represents a 50% increase and means that food production will also have to increase quite substantially to meet this future demand. The world's capacity to produce and distribute food has been under some stress in recent years. This has been caused by a rising demand, but also because of competition for land for other crops like biofuels, rubber and oil palm. Concerns about food production are increasing. In 2008, the market price index for rice rose by a staggering 270% during the course of that year. It subsequently fell but, in mid 2009, was still 50% above the level present only a year or so earlier (Economist May 30, 2009). The situation was deemed serious enough for some rice-exporting countries such as Vietnam to cease overseas sales during this period to ensure food security at home. New agricultural technologies may help increase the productivity of existing farmland but, in the decades ahead, it is also likely that more natural forest and marginal land will have to be used for food production. This could include quite unsuitable areas such as steep hills or sites with infertile soils. Based on past experience, farming on some of these marginal sites will fail and they will be abandoned. All of this means there may be less land available for reforestation in future and that the quality of much of the land that is available will be poor.

Urbanisation

The world's population is increasing, but the distribution of this population is also changing. Many rural people are leaving the country for urban areas and cities have recently grown to contain more than half the world's people. Global rural populations are projected to reach a maximum of 3.46 billion people by 2020 and then fall to 2.79 billion by 2050 (United Nations 2007). Within Southeast Asia, rural populations reached a peak of 313 million in 2000 and have declined since then. They are

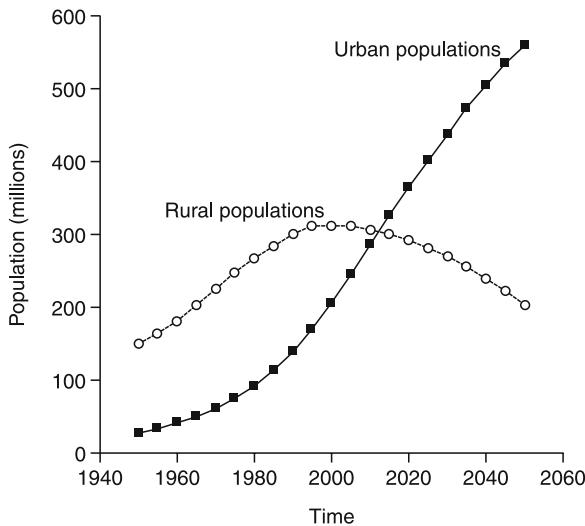


Fig. 12.1 Projected changes in rural and urban populations in Southeast Asia between 1950 and 2050 (United Nations 2007)

projected to fall to 205 million by 2050 (Fig. 12.1). By this time rural populations will represent only 27% of the total Southeast Asian population (down from 84% one hundred years earlier). Not surprisingly, there are large differences across the region. In Indonesia rural populations are expected to fall to 48% of their peak over this time frame while those in Vietnam are expected to only fall to 77% of their peak. In the Pacific, some urban areas will grow but most islands will have relatively stable rural populations.

The prospect of urban drift and a decline in rural populations led Rudel et al. (2005) to suggest this could be one trigger for reforestation (the ‘economic development pathway’). There are various ways in which this could happen. One way is by the amalgamation of farms. Rigg (2006) argues that rural lives and livelihoods are being increasingly de-linked from farms. Farming is becoming seen by many as a low status occupation and one in which it is difficult to improve household incomes, especially when landholdings are small. In his view, the best way of reducing rural poverty would be to help poor farmers leave their farms, especially those using more marginal lands. This would mean small farms were amalgamated and that fewer (wealthier) farmers managed larger farms. Under these circumstances there could be greater opportunities in these larger farms for an improved partitioning of land uses with crops grown on better land and trees on more marginal land. In this case, the understanding these farmers have about the opportunities offered by trees-planting will be crucial.

An alternative outcome might be something like what is now occurring in parts of Peninsular Malaysia where urbanisation appears to be leading to the development of significant areas of abandoned land (Jomo et al. 2004; Kato 1994). How this land might eventually be used probably depends on its spatial distribution. Large contiguous

blocks could be attractive to industrial groups interested in large agricultural or forestry enterprises. But such groups would probably be less interested in small fragmented patches of land. Might natural regeneration occur on these areas? Might they be attractive for commercial tree-growing by absentee owners?

A Rising Middle Class and Rising Environmental Concerns

A number of countries in the Southeast Asian region belong to the so-called ‘tiger economies’ with most experiencing long periods of sustained growth in recent years. This has led to a decline in (though certainly not an eradication of) poverty and the growth of a middle class. The change is already leading to a rise in the per capita consumption of food and other goods. This, together with rising populations, will limit opportunities for reforestation because many unused wastelands will be needed for new forms of agriculture, especially for meat production.

On the other hand, there is likely to be an increased public concern about environmental matters and conservation groups are now being found in many tropical countries (Koop and Tole 2001; Steinberg 2005). There are already signs that governments are also becoming more interested in environmental issues and conservation. For example, protection forests form a significant component of the national Five Million Hectare Reforestation Program in Vietnam (MARD 2001; Ohlsson et al. 2005). In recent years community groups in Australia and elsewhere in the region have been engaged in non-commercial forest restoration plantings (Elliott et al. 2000; Erskine et al. 2005). These changing social attitudes are already affecting the ways some timber companies design plantations, causing them to think more about the landscapes in which these plantations are established (Cyranoski 2007; Wooff 2009). There is also increased interest in timber produced in plantations that have been certified to have reached certain environmental standards and the possibility of consumer boycotts of timber produced by plantation companies that do not reach these standards (Laurance 2008).

New Markets for Forest Products and Ecosystem Services

Until recently, timber has been readily available throughout the region at relatively low prices because of largely unconstrained logging but this is likely to change. As the areas of unlogged natural forests decline, alternative supplies will have to be found. Projections are difficult to make and depend on assumptions about population growth and per capita consumption as well as global patterns of growth. Countries such as China and India that were once not heavily involved in the global market are now becoming major consumers of imported forest products.

A recent detailed study by Whiteman and Jonsson (2009) took account of the declining production from natural forests and foreshadowed a demand in the

Asia-Pacific region (including China, India, Japan and Korea) for industrial roundwood production (sawlogs plus pulpwood). They estimate it will rise from 86 million cubic meter in 2005 to 294 million cubic meter in 2030. The sawlog component was estimated to grow from 45 million cubic meter in 2005 to 233 million cubic meter by 2030. Projections based on recent plantings of fast-growing species using short rotations suggested the overall timber demand could be met from local plantations but that much of this production would come in the form of pulpwood and not sawlog timbers. While some pulpwood quality timbers can be reconstituted into other products such as panel boards, there could be a significant deficit in sawlog timbers in the region and a substantial surplus of pulpwood logs by 2030. On the other hand, there could be a compensatory rise in the market for biofuels that might use this surplus.

This leaves open the market for higher value, high-quality ‘cabinet’ or decorative timbers. Some of these timbers may continue to come from natural forests in the region or elsewhere (e.g. Latin America). Likewise, some are being replaced by bamboos or new technologies that are leading to improvements in the durability, stability and aesthetics of some of the utility timbers (including a product purporting to be a substitute for teak). But there appears to also be a potential future niche market for plantation-grown timbers of these species provided the log quality is high enough and a regular supply can be assured. Well-known plantation species such as teak (*Tectona grandis*), mahogany (*Swietenia macrophylla*) and rosewood (*Pterocarpus* spp.) already command attractive prices. But, given the biological diversity of the region’s forests, there should be opportunities for other high quality species as well, especially those coming from certified plantations. Efforts will be needed by growers to identify where these specialty timber markets are located and to form a relationship with them.

In the view of Leslie (2005), however, the real market opportunities of the future will lie in the provision of ecosystem services and the production of NTFPs. He estimated the value of ecosystem services provided by forests would more than double between 2010 and 2040. If he is right, this reinforces the need for silvicultural systems that are able to generate both high-value cabinet wood timbers and ecosystem services rather than those producing just utility timbers or pulpwood.

Climate Change

A changing global climate will have profound consequences for both the remaining tropical forests and for the prospects for reforesting some of the lands that have been deforested. Although there is a growing scientific consensus about the nature of the threat the impacts at particular locations are far less clear. But some things appear certain including the fact that there are likely to be changes in temperatures as well as in the amount and seasonality of rainfall in different parts of the Asia-Pacific region. The median projections from current climate models for the Southeast Asian region predict temperatures will rise by 2.5°C and annual rainfall by 7%.

In the case of rainfall, the increase could be up to 15% although dry seasons will be more severe (IPCC 2007). There is also likely to be an increase in extreme weather conditions including heatwaves and intense precipitation and a 10–20% increase in tropical cyclone intensities.

These changes, together with associated changes in fire regimes, will have consequences for most tropical ecosystems and many species will be forced to move up altitudinal or along latitudinal gradients. Others may retreat to niche refugia (Colwell et al. 2008; Williams et al. 2003). This will cause a reshuffling of communities because of differences in the sensitivities of species to environmental changes and the migration capacities of some species may not be able to accommodate the rates of change that are forecasted (Svenning and Condit 2008). A study of the distribution of *Eucalyptus* species in Australia is illustrative of the problem. Hughes et al. (1996) found 41% had natural distributions spanning areas with less than a 2°C difference in mean annual temperature (and 25% of species where the variation was less than 1°C). Likewise, 23% of species have ranges in mean annual rainfall that span less than 20% variation. Although the actual environmental tolerances of some species will be larger than the climatic envelopes they currently occupy, these relationships suggest many eucalypts (including eucalypts growing in plantations outside Australia) will be significantly affected by climate change. In the case of the tropical lowland flora, Corlett (2009) estimated the dispersal distances needed to compensate for climatic changes over the next century will exceed 100 km and this seems impossibly large for most plant species.

Climate changes of this magnitude will also affect human livelihood by changing the availability of water resources, the levels of agricultural productivity at particular sites and the activities of pests and diseases affecting agricultural crops and human populations. The net effect could be major changes in the geographic location of current food-producing areas and human populations. Poor rural communities are likely to be especially vulnerable to these changes.

There are two sets of responses to climate change and both will have consequences for reforestation policies. One set of responses are concerned with trying to avoid the changes by stabilising and then reducing atmospheric carbon levels. In the forestry context, this means reducing deforestation and degradation of natural forests and, at the same time, reforesting degraded lands to sequester more carbon. The international REDD+ (reduction in deforestation and degradation plus reforestation) schemes that pay forest and land owners for the carbon they currently store or will sequester in future are still being developed. If they do emerge they will make natural forest protection and reforestation more attractive land use options than they are at present (see previous discussion in Chapter 9). However, the workings of an international scheme and the future market price for carbon are still unclear. In the case of the reforestation options, might the high transaction costs involved in dealing with large numbers of small farmers exclude them from a scheme or will some regional body represent them? What will be the financial consequences in the carbon market of pulpwood plantations grown on short rotations and sawlog plantations grown on long rotations? Will soil carbon also be involved? These questions will be resolved over time. On the other hand, it is

likely that, in the immediate future, reforestation will continue to be driven by domestic policies such as land tenure arrangements and local institutions even though the prospects of a carbon market may sometimes tip the balance in favour of tree-planting.

The second approach to climate change assumes some changes are inevitable and seeks ways of accommodating or adjusting to these changes. This is likely to involve changes in both the location of various agricultural activities as well as in the crop species used at particular sites. Likewise the availability of land for reforestation may also change and some currently favoured tree plantation species may not be suited to some of the sites available for reforestation in the future. Reforestation may become more important in areas subject to heavier rain and erosion but less attractive in areas where water resources are limited. In short, it is still too early to say just how reforestation will be affected by climate change although the changes it will make are likely to be profound.

To summarise: there are a number of trends underway that will affect the amount and type of reforestation carried out in future. Some, such as urbanisation, may increase the opportunities for reforestation while others, such as rising populations, will have the opposite effect. Both patterns could occur simultaneously but in different parts of the region. Some trends, such as a rising interest in environmental matters and the changes associated with global warming also point to the fact that a wider variety of reforestation methods will be needed in the future. Of course there will be other changes as well such as increasing oil prices, changes in the price of fertilisers, rising demands for water and those arising from the process referred to as globalisation that are already affecting patterns of global trade. These trends are complex, sometimes contradictory and often hard to understand (Kates and Parris 2003). In many cases, the problems they create will be ones that few people will have had much experience in solving and future ecological and economic ‘surprises’ are likely. Any future forms of reforestation will have to be resilient and capable of adapting to these changes.

Undertaking Reforestation in the Future

Current patterns of reforestation are caused by an amalgam of market forces and government policy settings. The evidence suggests the present combination has been unable to promote reforestation at the rate needed or in the places where it is most required. Some new policy settings and institutional arrangements are needed to deal with the backlog of degraded lands needing to be reforested and to cope with the degree of uncertainty that is likely to be encountered in future. There are several specific questions that must be resolved:

- How to resolve conflicts over future land use (especially with agriculture) and how to identify areas where reforestation should be carried out in future to protect watersheds, conserve biodiversity or accommodate the changes induced by global warming?

- How to develop non-financial incentives to make large-scale reforestation an attractive land use alternative?
- How to develop – and promote – new forms of reforestation able to supply the goods and ecosystem services required in future as well as methods for reforesting particularly degraded areas?
- How to access capital and develop financial mechanisms that make investing in long-term forestry ventures attractive and that also reward those supplying ecosystem services?

The Role of Markets

Markets can be important drivers of reforestation and create incentives for innovation and entrepreneurship. Both the ‘economic development pathway’ and the ‘forest scarcity pathway’ identified by Rudel et al. (2005) are ways in which different types of market activity can increase forest cover over large areas. For reasons outlined earlier, some combination of the two may be especially powerful in future. People are more inclined to carry out activities such as tree planting if they know that they, or their families, will benefit from doing so. This means that those seeking to increase forest cover must be aware of the formidable role of markets in synthesising information and changing people’s behaviour. This role is especially important given the variety of uncertainties described above.

Despite their undoubted power, markets have some significant limitations. Firstly, unregulated markets do not always generate ecologically satisfactory outcomes. Markets can easily value goods such as timber, pulpwood, oil palm or real estate. But are mostly unable to put a market price on biodiversity or clean water until after the system passes some kind of degradation threshold by which time it may be difficult and expensive to cross back. Nor are markets very good at sending signals that induce people to rehabilitate severely degraded lands. Sometimes special financial instruments can be developed to deal with these types of problems. But there will always be situations where markets cannot be relied upon and governments must step in and demand, or initiate, appropriate forms of reforestation on behalf of the community.

Secondly, markets are affected by geography. In isolated locations such as remote highland areas or isolated Pacific islands there may be no market because of high transport costs. In other cases, the high cost of transport can mean the only market is for more valuable products such as specialty timbers. The geographical distribution of market links also matters. Foster and Rosenzweig (2003) found there may be little relationship between the local demand for forest products and forest cover when economies are open and buyers can purchase these products from a wide variety of sources. This means deforestation can continue without generating an incentive for local landowners to carry out any reforestation. The situation may be quite different, however, if economies are more closed, or when local growers do supply much of the local demand.

Thirdly, markets may not work well when it is difficult to respond quickly to a market signal. Reforestation takes time and it may be some years before goods or services can be produced to supply a market previously supplied by natural forests. Clever landowners able to monitor the situation might be able to anticipate such future market signals and begin reforesting to supply this market. But, in most local situations, there are few landowners with a sufficient overview of what is occurring for this to happen.

Finally, unregulated markets do not always produce socially acceptable outcomes and in some cases they can cause extreme hardship to some segments of society. Obvious examples are when sudden price changes devalue the worth of a smallholder's crop or plantation or when there is only a single buyer able to dominate the market and set prices that suit themselves.

The Role of Governments

Governments have a uniquely important role in facilitating reforestation (Table 12.1). In the past, government agencies often carried out reforestation to compensate for the loss of natural forests by creating timber resources to provide rural employment or to protect certain environments such as coastal zones or mountain areas. But, in recent years, most governments have been less active in reforestation because of shortages of land and financial resources. Some have established wholly-owned entities to establish and manage plantations with largely commercial objectives (e.g. Peruntani in Indonesia, State Forest Enterprises in Vietnam and the Forest Industry Organization in Thailand). Some have sought to promote reforestation (and avoid further degradation) by devising new policies. Among the most important of these are the provision of land tenure and legal frameworks governing ownership rights. Some have also reviewed policies that discourage reforestation including tax regimes and cumbersome administrative procedures and have provided financial incentives of various kinds to make reforestation more attractive. Many have also sought to enhance the economic benefits of reforestation by creating supporting infrastructure such as roads to get goods to markets and by reducing the complexity of market chains and the costs of marketing.

Much future reforestation will probably be carried out to provide certain ecosystem services rather than just timber production. In such cases it will be the location of reforestation within a landscape rather than just the area covered that is important. Governments are uniquely equipped to take a broader perspective than most other land managers and identify where reforestation should be carried out for the national benefit. These locations might be eroding mountain areas, sensitive coastal zones or areas of high conservation significance. Governments can offer incentives or subsidies to ensure such sites are treated and legitimize tree-growing as a profitable land use activity. Governments can also help reduce some of the risk from reforestation by initiating silvicultural research and by developing extension services to share this knowledge. More often than not, governments have provided

Table 12.1 Participants in reforestation and some of the advantages they have in being able to promote reforestation as well as their disadvantages

Participants	Advantages	Disadvantages
Governments	<p>Can identify where reforestation should be carried out in the national interest</p> <p>Can provide technical information to growers and undertake long-term silvicultural research</p> <p>Can provide policy and governance framework (e.g. land tenure, legal system, tax system, enforce regulations)</p> <p>Can improve operation of markets (e.g. costs of externalities recognized, share market information, reduce costs of marketing)</p> <p>Can provide supporting infrastructure (e.g. roads)</p> <p>Have a convening and organising capacity (e.g. to arrange PES including carbon markets, monitor water quality or occurrence of pests and diseases)</p>	<p>Often have limited understanding of local issues or constraints faced by smallholders</p> <p>Silvicultural prescriptions not always relevant to social or economic circumstances of growers</p> <p>Often undertake narrowly focussed research</p> <p>Sometimes unable to implement policies because of limited on-ground capacity</p> <p>Sometimes impervious to advice or feedback</p> <p>Sometimes captured by special interests</p>
Private companies	<p>Can assemble funds and expertise to reforest large areas</p> <p>Often technically and financially efficient</p>	<p>Use limited variety of species</p> <p>Mostly prefer pulpwood plantations, less interested in long rotations or more complex forms of silviculture</p> <p>Uninterested in degraded sites, limited interest in biodiversity conservation</p> <p>Usually prefer short financial investment periods</p> <p>Sometimes work at only small spatial scale</p> <p>Sometimes their funding means they can only work for short periods</p> <p>May have narrow interests (e.g. only conservation outcomes)</p> <p>Their number and diversity often makes coordination between NGOs and with governments difficult</p>
NGOs	<p>Can influence public awareness of importance of reforestation</p> <p>Able to work closely and build trust with communities, farmers and local champions</p> <p>Are often sources of technical expertise and funds</p> <p>Often linked to international networks providing access to new ideas</p>	

(continued)

Table 12.1 (continued)

Participants	Advantages	Disadvantages
Community	Have capacity to enforce protection of forest areas	May not have a single viewpoint; possibility of internal conflict over land use objectives or need for reforestation
	Can develop suitable rules governing usage of natural forests	Limited knowledge of commercial plantation silviculture techniques
	Hold traditional ecological knowledge about area and its species	Limited knowledge of markets
	Sometimes able to foster restoration plantings (for cultural or religious purposes)	Lack national perspective
	Often have a convening and organising capacity	
Private smallholders	Often have considerable agroforestry expertise	Many (but not all) have less technical expertise
	More inclined to use variety of species and plantation designs	Unlikely to be able to tackle most degraded sites
		Limited interest in biodiversity conservation
		Often unable to tolerate risk
		Lack national perspective

the institutional memory that safeguards much of this formal scientific silvicultural knowledge (but see Box 12.1 for an example of the risks inherent in there being only one knowledge node). Finally, governments have a special convening and organising capacity that enables them to link all those with a stake in forests to undertake national or regional reforestation initiatives such as developing systems of payment for ecosystem services. In short, large-scale reforestation is likely to be difficult without some degree of active government support.

But it is easy to over-estimate the role of governments and lose sight of the fact that many of the policies they have adopted in the past have been inappropriate. Top-down approaches that pay insufficient account of local practices or realities often run into problems and examples of this can be seen across the Asia-Pacific region. Sometimes local communities filter (or ignore) central government directives or add rules that have been generated by local institutions. Vietnam, for example, has a large national reforestation program and its forest cover is increasing (MARD 2001). However, a number of authors have argued that some reforestation in Vietnam has happened despite, rather than because of, the government's policies (Clement and Amezaga 2008; Fahlen 2002; Sikor 2001; Sowerwine 2004). Sometimes land supposed to be planted with trees was far more valuable to local farmers as agricultural land and its reforestation could have caused unnecessary stress. In such cases communities have found ways of circumventing government directives and achieving plausible outcomes although different to those intended.

Box 12.1 Losing Knowledge

It is commonly assumed that knowledge steadily accumulates and that, speaking collectively, we know more now than we did last year. In fact, this is not always the case and a striking example from the Solomon Islands illustrates the point. Between 1998 and 2003 a period of disturbances and lawlessness occurred in the Solomon Islands. This resulted in the disintegration of government activities and the breakdown of an effective civil service. One national government agency badly affected by these events was the government's own agriculture department. In the absence of staff, rain, mould and termites entered government offices in the capital Honiara and effectively destroyed many of the department's records. These included most of the department's agronomic and soil databases as well as records of field trials and reports carried out by international aid consultants (Barry Evans, personal communication, 2008). Some of this information could be retrieved from district offices away from the capital but much else had to be sought by consulting former staff, including expatriate and former colonial-era staff no longer living in the country. In effect, an attempt had to be made to create a retrospective network of knowledge-holders.

Elsewhere, knowledge has been lost when key staff retired, organisations have been restructured, fires have burned government buildings or computer disks have been inadvertently wiped clean. Erskine et al. (2005, p. 270) describe several cases from northern Australia where the organisational restructuring of government departments showed seemingly impregnable 'institutional memories' were much less secure than was imagined.

Nor have governments always been very innovative in either the silvicultural techniques they have promoted or the financial instruments they have used. Thus they have often recommended 'safe' silvicultural approaches that have been successful elsewhere rather than exploring silvicultural systems that might suit the environmental (or economic) circumstances at a particular site. For example, in recent years, most government research has concentrated on the same small number of 'fashionable' exotic species and looked for ways to increase the productivity of plantations using these rather than exploring a wider variety of options. Sometimes the farmers taking this advice have been disappointed with the outcome (the dangers of a single, top-down prescription have already been noted in the case of the rice planting problem and the Islamic calendar described in Box 2.1). Some governments have also provided financial support for reforestation although this has often been given to favoured companies rather than being used more generally for the national interest.

The Role of Plantation Timber Companies

In recent years private timber companies have reforested some large areas and it is likely they will continue to do so in future. Some have done this without government support but many have received substantial financial incentives or taxation concessions from governments to attract them to do so (Enter et al. 2003; STCP 2009). The strong commercial imperative of these companies has meant that some have developed highly efficient plantation operations (although, it must be said, others have not and there are many examples of company plantations that have failed).

Most industrial plantations have been established on grassland or secondary regrowth although some have replaced natural forests (and some companies have logged natural forests in order, they say, to establish plantations but have then failed to do so). Few companies have used highly degraded sites or those with infertile soils unless these disadvantages could be compensated for by gentle topography and good locations close to transport (apart from those mining companies legally obliged to do so). Most industrial timber plantations are grown on a short rotation for woodchips, pulpwood or for veneer and only a few companies have invested in sawlog plantings. Because of this, the range of species used has been comparatively small. In future these companies are likely to continue with this type of reforestation. Those that have undertaken any research have largely confined their activities to improving the productivity of their chosen species and few have explored the role their plantations might have in generating ecosystem services although a carbon market could dramatically change this.

However, this pattern is changing. In recent years some timber plantation companies are beginning to pay more attention to the landscapes in which they establish their plantations and try to embed them within a matrix of secondary forest regrowth on steeper lands and along water courses (Cyranoski 2007; Wooff 2009). More are making more effort to ensure harmonious and beneficial relationships with local communities (e.g. Marjokorpi and Otsamo 2006). These are significant changes and, together with moves towards the certification of plantation timbers, mean that companies could play an important future role in helping to reforest cleared lands in ways that provide some environmental and social services in addition to goods. Mining companies, too, are increasingly involved in research to develop better ways of rehabilitating former mine sites.

The extent to which private companies will continue to invest in timber plantations depends on the availability of land, how their funding sources perceive the future profitability of these investments and also on the economic and political risks involved. The willingness of governments to continue offering incentive payments or tax concessions so these companies can continue tree-planting is likely to remain crucially important (STCP 2009). It is possible that some companies could switch to an alternative crop such as oil palm or other land uses if this was deemed to be more financially attractive than timber tree plantations.

The Role of Non-Government Organisations

In this context, the term NGO is used in rather broadly and taken to include local and international conservation organisations, international development assistance groups, university researchers as well as organisations like farmer's associations. This diversity makes it hard to generalise about the role of NGOs but it is clear they have been very influential in raising public awareness about environmental issues and of the need for reforestation (Table 12.1).

NGOs usually have different priorities than governments and have often sought to change government policies. For example, while recognizing the need to improve rural livelihoods, some place a much higher priority than governments on the need for reforestation to protect biodiversity. These differences mean they have often promoted a wider range of silvicultural options than used by most government agencies or timber companies. They have also often taken a lead role in improving information flows and promoting new financial instruments such as payments for ecosystem services.

Most NGOs have taken a more participatory approach than governments and have often worked in smaller, more intimate relationships with local partners. On the other hand, some NGOs have also been able to work across several scales and have formed relationships with national governments, international bodies and corporate entities. This has allowed them to bring in new ideas and techniques from comparable situations in other countries. However, NGOs have some disadvantages. Some have limited budgets and can only tackle short-term projects; this is a severe disadvantage when working on reforestation. And, where there are large numbers of NGOs operating, each with differing objectives, capabilities and time frames it can be difficult to coordinate their activities. This can reduce the overall impact of their potential contributions.

The Role of Households and Communities

Most of the large reforestation efforts in the past have been carried out by government agencies and timber companies. But one of the themes of this book is that smallholders and communities are an unrecognized or under-valued group of potential growers. When given the opportunity, communities and households have often been very effective at protecting small patches of residual forests, including new secondary forests, and enforcing rules governing access and usage (Table 12.1). In addition, households and communities have also established some very large areas of plantation even though individual plantings are usually small (Table 3.3). The scale of these contributions are substantially under-estimated because the individual areas involved are mostly small and because several countries, apparently, do not collect any statistics on smallholder plantings.

Households are primarily interested in reforestation because of the direct livelihood benefits it can bring but their plantings often generate a wider range of conservation benefits and add heterogeneity to rural landscapes. This is

not because they are more selfless than governments or private timber companies. Instead, it is because they are growing trees for a wider range of purposes and are prepared to use a more varied set of silvicultural methods. Not all of these methods are ideal from a commercial point of view and many smallholders are poorly informed about markets for their forest products (let alone any ecosystem services they generate). Nor do they necessarily know the species or silvicultural methods most likely to allow them to take advantage of future markets. This is why the learning networks described in Chapter 10 are so important. Farmer's views and aspirations change over time as new markets appear and new opportunities arise and their future interest in reforestation, and as well as their capacity to undertake it, will be heavily influenced by government policies.

In summary, there are a number of groups interested in reforestation and able to make a contribution in the future but no one of these various players – governments, companies, NGOs or smallholders – has all the skills needed to address the four questions raised earlier (i.e. how to undertake better land use planning, devise incentives for reforestation, develop new forms of reforestation and devise new financial mechanisms to encourage reforestation?). On the other hand, there is considerable complementarity between these groups and also the potential for some considerable synergies between them. The best outcome would be if they could be somehow be brought together. But how might this be done?

New Institutional Settings to Encourage Reforestation

When social-ecological systems are complex and face an uncertain future then the form of governance required is one that is able to deal with this. Large-scale and centralised forms of governance are unlikely to be adequate. In recent years, there has been considerable interest in how communities have developed ways of managing common property resources and so avoided the 'tragedy of the commons' (Ostrom 2005). Plantation forests, and especially those established by smallholders, are not common property resources like fisheries or water used for irrigation. Nonetheless, the extensive literature concerning how communities have evolved methods to manage common property resources provides a lens through which to examine the institutions that might be developed to foster reforestation on a larger scale. Despite the obvious differences, there are also some similarities between the situations faced by managers of these natural resources and those establishing plantations. Firstly, both managers of common property resources and tree-growers are concerned with restoring or re-creating a resource. Many common property resource institutions and management regimes only develop after it becomes obvious that the resource is being over-exploited. Likewise, those carrying out reforestation are usually prompted to do so when natural forests are unable to supply the goods or services they once did.

Secondly, in both cases, participants depend on collective action to generate benefits. Tree-growers can establish trees, whether or not their neighbours do so, but they may depend on their neighbour's plantations to create a sufficient resource to make their own trees commercially valuable. Without a regular and predictable supply of a product, a single, small plantation may be virtually worthless. Likewise, a single small plantation may be unable to provide ecosystem services such as watershed protection or biodiversity conservation. In short, the supply of both goods and services are scale-dependent meaning that collective action is needed to generate a benefit.

Thirdly, both sets of participants, consciously or unconsciously, also depend on collective action to manage the new resources and maintain them over time. Markets depend on reliable supplies of goods and services. When plantation owners withdraw from the market (e.g. by felling trees and not replanting) they may diminish the economic and ecological value of the remaining resource. Note that those withdrawing at an early stage do not suffer because they sell before the costs of their withdrawal become evident. In this sense, these people are the plantation equivalent of common property resource free-riders (Ostrom 1990).

Several design principles have emerged from studies of the institutions used to manage common property resources (Ostrom 1990). Some of these are concerned with rules governing access to existing common property resources and with penalties for infringing these access rules. But there are also several that appear to bear directly on the task of promoting reforestation. These are:

1. Collective choice arrangements: those affected by policies and rules should have a role in formulating these.
2. Congruence between policies and local conditions: policies and rules developed at a national level should be consistent with local conditions.
3. Nested enterprises: when the resources (or plantations) are parts of larger systems, then rules and procedures developed at one level (e.g. a district or province) must complement or be integrated with those at another (e.g. national).
4. Conflict resolution: participants should have low-cost access to local arenas to resolve conflicts among themselves or between participants and the government.

Some of these principles are reflected in the various forms of 'participatory', 'joint forest management' or 'community-based forest management' that have developed in recent years (Fisher 1995; Petheram et al. 2004). But how might these principles be used to encourage reforestation at a national scale?

A System of Cooperative Advisory Groups

Perhaps the strongest of these lessons is the first one concerning the importance of having stakeholders involved in the development of policies that affect them. Once stated, the advantages seem self-evident; those most intimately involved in the

day-to-day business of reforestation are likely to be better equipped to identify problems (or opportunities) than those in remote government offices. On the other hand, there is undoubtedly also a need for a central government body to retain an overview and be able to coordinate activities. In any case, few government Forestry Departments are likely to give up their dominant role in establishing and administering policy.

One solution would be to develop a form of governance that brought the various parties together. A way of doing this could be to have a system of cooperative advisory groups. These groups could include representatives from private plantation companies, farmers' groups, NGOs and other government agencies such as agricultural and conservation departments. In addition, the groups might involve timber industry representatives, users of the ecological services provided by forests and non-government specialists such as resource economists, land use planners and conservation biologists. The purpose would be to link all those interested in reforestation and allow them to share views on the effectiveness of current policies and how impediments to further reforestation could be overcome.

Some of the specific issues to be addressed might be:

- The policies and practices needed to prevent further forest and land degradation.
- Ways of developing more participatory forms of land use planning (e.g. Where might reforestation rather than agriculture be a priority? How to respond to climate change? How to balance national needs for, say, watershed protection against the livelihood needs of individual landowners? How to use abandoned wastelands?).
- The policies needed to protect secondary regrowth or encourage plantings by both smallholders and industrial companies (e.g. land tenure, property rights, the role of incentives, removal of perverse subsidies, taxation issues, micro-finance, silvicultural needs of different types of farmers).
- How changes in reforestation practice might be monitored and evaluated over time so that alterations could be made to policies in response to changing circumstances (e.g. Are rural livelihoods being improved by reforestation? Are equitable arrangements being used in out-grower schemes? Are ecosystem services being produced in national or provincial reforestation programs to the extent that governments assume?).
- Ways of liaising with the learning networks of Chapter 10 to ensure coordinated national research efforts are carried out on common problems.
- The role of markets and market-based instruments in funding reforestation programs (e.g. business models for smallholders; the ways in which local industries able to process forest products might be supported, how reforestation can tackle poverty and improve livelihoods?).
- The identification and development of new markets for forest products as well as ecosystem services (e.g. ways of improving financial benefits to forest growers, ways of supporting small rural industries using forest products, ways of entering carbon markets and using these to benefit smallholders as well as large companies,

location of reforestation areas for ecotourism, encouraging smallholders to achieve certification of their plantations).

- How to ensure that legal ambiguities are avoided and that national, provincial or local reforestation policies are harmonised. Likewise, ensuring that reforestation policies of forestry agencies do not conflict with land use policies of other government agencies.

This is a formidable list and it would be sensible to have a network of sub-groups specialising in different topics rather than a single body. Alternatively, separate groups located in different geographic areas might be able to give feedback on draft national policies by exploring local views on how these policies might work in practice. All groups would be coordinated by, and responsible to, a central advisory body on which each of the primary stakeholders was represented.

Those studying the way different kinds of institutional arrangement work have often concluded that diversity is beneficial. Having separate groups working on the same issue often results in a variety of solutions that are all worth exploring and testing. Bodin and Norberg (2005) have demonstrated how loosely organised networks are more likely to be successful than a tightly organised one because they are likely to generate multiple solutions. Similarly, Ostrom (2008) concluded that there are considerable advantages in having seemingly redundant design teams when the problem being worked on is such there is a high probability of errors being made.

The groups or network then ensures that information sharing becomes a bottom-up as well as a top-down process. Because information is shared across the network it avoids the problem of having a single centralised repository of knowledge (see Box 12.1). The matter of how these collaborative groups might be established and the advantages of this type of approach is discussed in rather more detail by Sayer and Campbell (2004), Anderies et al. (2004), Olsson et al. (2004, 2006), Lebel et al. (2006) and Berkes (2007).

The work done by a set of advisory bodies such as these differs from that carried out by the silvicultural learning networks described in Chapter 10 by being broader in scope and involving more than just growers and researchers. But, in a sense, the idea is simply an enlargement of the same vision in which greater benefits and a more resilient form of adaptive management can be developed when those with a stake in the outcome of reforestation are involved in establishing policies governments use to promote it.

One of the other features of the institutions emerging over time to manage common property resources is that they usually establish penalties to prevent rules being circumvented (to avoid what is referred to as the ‘free-rider’ problem). Penalties to prevent free-riders are not as relevant in the present situation. In fact, one of the purposes of the advisory groups is to spread knowledge about management systems as widely as possible. There are advantages in collective action to coordinating sales of products emerging from plantations but it would be extremely difficult to insist on this being done and, in any case, would probably be counter-productive. A far better approach would be for the advisory network to encourage producers to see this as being in their own self-interest.

Problems in Implementing Change

These are hardly radical proposals but most governments jealously guard their powers and are reluctant to share them with others. This is especially true of the relationships between Provincial and National governments. And forestry departments are often especially resistant to change. Muthoo (2009) notes that forest authorities are sometimes among the oldest, largest and most powerful land management agencies in many countries. Their long tradition has facilitated an administrative sense of mission that perpetuates established norms and traditions and makes them resistant to external pressures. Unlike farmers who are usually pragmatists and often open to new ideas, many bureaucrats are not always receptive to alternative ways of establishing forests or managing lands. Even when changes are agreed to at forestry headquarters, local officials are often reluctant to implement them in the field. This may be because of professional egotism, a genuine belief that the changes will lead to the overturning of national land use practices that they support or sometimes, it must be said, a belief that the devolution of power will curtail their ability to manipulate events for personal financial gain (Edmunds and Wollenberg 2001). Both governments and their staff can often find ways of slowing or preventing change by having lengthy approval processes or burdensome administrative procedures.

Problems can also occur in on the non-government side when trying to create advisory groups such as:

- It can be difficult to identify non-government participants who are truly representative of other stakeholder interests and who are prepared to be accountable to their constituents. It may be possible to use traditional community leaders but communities made up of recent migrants rarely have the coherence of traditional communities while the institutions and leaders once present in traditional villages are sometimes overwhelmed. New organisations like growers associations could provide representatives but these are not always present or active.
- Not all parties may wish to be involved. For example, some larger corporations may prefer having one-on-one discussions with governments when matters of particular interest to them arise. Others may not think it worth the effort.
- The process can be captured by local elites who find ways of manipulating the process to suit their own purposes. Similarly the process can become corrupted, especially if large amounts of external funds (e.g. aid funds) are involved.
- Differences in the views of, say, powerful industrial corporations and small local growers that make collaboration or agreement difficult. For example, small growers may see large corporations being competitors rather than partners. Likewise, some participants will expect their views to carry more weight than their fellow member. Ways will need to be developed to take account of these differences if the group is to work together effectively. Some principles that might increase the effectiveness of the consultation process are outlined in Box 12.2.

Box 12.2 Consultative Principles

Alexander (2009) suggested a set of principles that might allow effective consultative networks develop. They were developed for forest conservation practices in general rather than reforestation in particular but are still relevant. They need to be discussed, and agreed to, by stakeholders if they are to be useful.

1. Engage a broad range of stakeholders

These should represent civil society, industry and various levels of government. An issue to be resolved is how representatives are chosen to ensure the each sector is given a voice.

2. Institute reliable operating structures and processes

These are needed to ensure meetings are planned and effective. Representatives need to feel their voices will be heard.

3. Practice transparency

The results of the group's work need to be shared so all those with an interest in the topics discussed are able to take advantage of the outcomes.

4. Use effective communication channels

Different forms of communication may be needed for different stakeholders.

5. Foster a focus on interests and not positions or personalities

The group will work best if vested interests are put aside and the group works for the common good.

6. Allow for independent verification

It may be useful to have outside entities or consultants check findings or conclusions.

7. Be responsive to all concerns

The group may not be able to tackle or resolve all the concerns that it is asked to address. Care should be taken to ensure the needs of smallholders are given as much attention as those of industry.

8. Make use of existing networks

Existing growers, industries or marketing networks should be utilised to share knowledge, communicate concerns and solicit feedback and advice.

9. Undertake capacity building

Build the capacity of stakeholders to use new information and knowledge and to benefit from the group's work.

10. Undertake periodic reviews

Periodic reviews are useful to ensure the purposes and objectives of stakeholders continue to be met as ecological, social and economic circumstances unfold.

The history of devolution of natural forest management in the Asian region has been extensively reviewed by Edmunds and Wollenberg (2001) and they conclude that many of the outcomes have been disappointing. Muthoo (2009) also gives an equally dispiriting account. Might it be different when the objective is to create new forests rather than manage existing ones? One answer is that it may be difficult to expect government forestry agencies to devolve authority or explore more participatory forms of governance in the reforestation sector in times of rapid economic growth, where there is a scramble by investors to acquire land or where there is intense inter-agency competition within government circles for resources and influence. These are occasions when trust can be in short supply and deceptive or selfish behaviour is more common. Under such circumstances governance often worsens and democracy sometimes malfunctions (Collier 2007).

On the other hand, promising changes have appeared when, after repeated failures, it becomes clear that something different is needed. This was the case in the Philippines where it was evident that reforestation would only occur if a completely new set of institutional arrangements were developed (Chokkalingam et al. 2006). Collaborative arrangements also seem to work best when there are at least several ‘champions’ of the idea who are prepared to work to make them succeed. One collaborative forestry network that has worked well is one developed in Fiji to carry out land use planning for reforestation in the Drawa forest area. This was briefly described in Box 11.2. In this case, the champion was the German development agency GTZ and the real test of its usefulness will come when this external champion (and the funds it provides) departs. Given that most land in Fiji is owned by traditional communities, among whom there is likely to be much greater levels of trust, participatory forms of planning and forest development should work well there.

Despite setbacks of the type described by Edmunds and Wollenberg (2001) and Muthoo (2009), there appears to be a general trend towards devolution across the region and sufficient promising examples are emerging to show that collaboration and networking amongst forestry stakeholders is not only possible but can also be beneficial (Gilmour and Fisher 1991; Hobley 1996; Magno 2001; Sayer and Campbell 2004).

Revisiting Resilience

The development of an appropriate institutional framework is the final step in building resilient social-ecological systems at deforested or degraded sites. The topic of resilience is one discussed at several stages throughout this book and the variety of future uncertainties outlined at the commencement of this chapter means it is

appropriate to return to the idea once more in order to synthesize these different discussions.

Recall that there are three elements of resilience within social-ecological systems, namely an ecological component, an economic component and a social component (Table 12.2). Making reforestation ecologically resilient involves ensuring the new ecosystems have sufficient biodiversity such that one functional species type can be supplemented or replaced by another when conditions change. This might be achieved at a particular site by growing mixed-species stands, or it might be achieved across a landscape by creating a mosaic of simple monocultures each involving a different species. There is no way of knowing just how much diversity is needed given the variety of changes that may occur in future. This means there should be some kind of a monitoring system in place to track the changes that occur and monitor the capacity of the ecological system to adapt itself to these changes. Signs that the new forests cannot adjust to the changes being experienced and are being pushed towards some kind of a threshold would be the trigger for management changes.

The second element is the economic one. Land managers with tenure are likely to consider reforestation as long as they think it will produce a satisfactory economic outcome. These benefits may be from the goods being sold or from payments for ecosystem services they provide to external bodies. The greater the

Table 12.2 Components of a resilient system of reforestation

Ecological	Economic	Social
Diversity of species used (differing in their functionality and in the economic products they generate)	New forests able to produce a variety of goods	Land tenure and property rights provided
These grown in polycultures	New forests able to generate ecosystem services	Supportive institutions including stakeholder advisory networks established
Spatially heterogeneous landscapes developed	Diverse markets available for goods and services	Learning networks for growers established
Ecological monitoring systems developed	Market information available to land managers	Growers associations and marketing cooperatives developed
	Growers can easily access markets	Equitable systems of governance including legal systems developed
	Economic monitoring system developed	
	Supportive policy environment for rural forest industries (e.g. sawmills, furniture factories)	

variety of markets available to growers, the more resilient the system is likely to be. But declining prices for goods or services, a sharp reduction in the number of buyers, increased costs of bringing goods to markets or increasingly complex administrative systems all act as warning signals to growers that something might be amiss. Again, a monitoring system that provides an early warning of adverse changes is essential so growers can develop responses in management practices or even in land use before it is too late.

Lastly, the system must be socially resilient. A socially resilient system is one where growers are aware of ecological and economic feedback and are continually engaged in testing and refining their practices. This means they can adapt to change and modify their silvicultural and economic practices if it becomes necessary to do so. This kind of responsiveness is encouraged by a supportive institutional framework and equitable forms of governance. It is also encouraged by a financial environment where there is access to funds and loans that can help when crises arise and changes are necessary.

These principles may be satisfying for theoretical ecologists, but how appealing might they be for smallholders and other stakeholders interested in reforestation? The most difficult component of resilience to promote will undoubtedly be the ecological elements. Despite the diversity of species used in traditional agricultural systems there appears to be a relentless move towards monocultures. Part of the dilemma is that ecologists cannot specify how much diversity is needed to generate a certain quanta of resilience. If a grower asks, should I use three species or six or ten, an ecologist can only admit that they are not sure; it depends on the nature of the future changes that may occur. In some cases three species might be sufficient while in others it will not. The dilemma may resolve itself in the sense that large industrial growers will mostly continue to grow monocultures but many will do so by embedding these monocultures within a diverse landscape mosaic of regenerating secondary forests. At the same time, many smallholders will continue following their conservative inclinations and grow a variety of trees species not because of the ecological virtues of doing so but because of the economic benefits they receive from maintaining this diversity. And again, their farm and plantation will be just one in a landscape mosaic that includes woodlots, home gardens, secondary forest and residual stands of primary forests. That is, some ecological resilience will be achieved at individual sites but it might be more easily achieved at the landscape scale.

Building economic resilience may also be difficult. Most farmers are inherently cautious and may be interested in producing several income streams as a way of insuring themselves against unexpected change. This means they should be receptive to the principle of building economically-resilient forms of reforestation even though commercial tree-growing is likely to be a new land use activity for most of them. But it depends on circumstances. Those acting as out-growers and having a long-term contract with an industry partner might not see any purpose in having more than one product stream because they believe their contract provides them with a form of insurance against change. Others selling a single product into a currently profitable market might have a similar view. In both cases they would diminish their income if they diversified their products. On the other hand, diversification might be

easier to promote when growers live in more isolated areas or where market conditions are less predictable. Given the future uncertainty of the market for commodity timbers described earlier and the increasing interest in ecosystem services, the best way of promoting economic resilience will be to educate growers into the nature of the past and likely future markets for forest products and services. In the meantime, efforts should be made to maintain the existing rural industries that consume the goods produced by forest growers and continue support for research into ways these markets might be diversified and new niche markets encouraged.

Perhaps the easiest component of resilience to promote will be the social elements. Many growers are already members of farmers groups and are likely to be very willing to join grower cooperatives to share knowledge or help them market their produce. The advantages are self-evident and there are few costs apart from the time invested. There seems no reason why this could not be enhanced by such devices as the Learning Networks (Chapter 10) and the Cooperative Advisory Group system of this chapter. Some of these social interactions will take place without government support or involvement. Others may need government assistance to begin even though the role of government may eventually decline.

The promotion of resilience will be a long-term business. Commercially-oriented reforestation is still a new land use activity and the majority of plantations were only established after 1970. Many are still in their first rotation. This means that most growers are yet to experience the full range of ecological risks including pests and diseases, fires, storms or droughts. Similarly, the economic conditions under which they were established may not continue into the future. It is likely, therefore, that at least some present silvicultural practices will prove to be unsustainable in the longer term. Roberts (2009) has argued that much of the world's food production system is already monolithic and brittle. There is a danger that plantation silviculture could fall into the same high-risk trap unless deliberate steps are taken to avoid it.

Conclusions

Large scale reforestation needs some coordination. Some reforestation will occur when market conditions attract landholders to plant commercial tree crops. It can also occur when regrowth develops on abandoned land. But neither of these pathways will necessarily lead to reforestation of areas most in need of reforestation such as eroding watersheds or areas important for the conservation of biodiversity. Nor will they necessarily lead to any improvement in the livelihoods of rural smallholders who could benefit from growing trees on part of their land. If reforestation is to improve environmental outcomes, or rural livelihoods, then some form of government involvement is usually necessary in order to coordinate and perhaps guide reforestation. The question is, just how big a role should governments play? In the past, much reforestation was actually carried out by government forestry agencies and these usually took a largely top-down approach when dealing with others interested in planting trees.

Thus, they tried to specify the species to be planted and the way the plantation should be managed. While this approach had some successes (as well as some failures), it is unlikely to be very successful in the future. The variety of potential forest growers has increased and these have a much wider range of objectives than past government forestry agencies. In addition, the environmental and economic conditions of the future seem rather less predictable. This means that past forms of reforestation may be quite inappropriate.

Studies of the arrangements used by other long-lasting natural resource management groups suggest the best way of evolving new institutions able to foster reforestation are those that build on the capacity of groups to organise themselves. Governments have a critical role to play in helping this to occur by encouraging the formation of networks of advisory groups involving representatives from smallholder groups, industry and NGOs. These groups could help identify the impediments and then cooperate with governments to develop new policies that foster reforestation at both a local and national scale. The development of supportive institutions able to formulate and guide appropriate reforestation policies represents the final elements in a framework of factors likely to lead to the creation of resilient new forest ecosystems.

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